Department of Energy
Washington, DC 20585

MAR 1 0 2006

MEMORANDUM FOR DAVID C. MOODY
MANAGER
CARLSBAD FIELD OFFICE

FROM: DAE Y. CHUNG
ACTING DEPUTY ASSISTANT SECRETARY FOR
INTEGRATED SAFETY MANAGEMENT
AND OPERATIONS OVERSIGHT
ENVIRONMENTAL MANAGEMENT

SUBJECT: Approval of the Safety Evaluation Report for the Waste Isolation Pilot Plant

Reference:
1. Safety Evaluation Report of the Waste Pilot Plant Remote Handled Waste Documented Safety Analysis and Technical Safety Requirements, Revision O, (DOE/CBRO-06-3334); dated March 2006

Based on my review of the Safety Evaluation Report (SER) in Reference 1, I am approving the SER for the Waste Isolation Pilot Plant Remote Handled Waste Documented Safety Analysis and Technical Safety Requirements.

I have signed the attached SER for your records and transmittal to Washington TRU Solutions LLC. If you have any further questions, please call me at (202) 586-5151.

Attachment

cc: Inés Triay, EM-3

APPROVAL

Safety Evaluation Report
of the
Waste Isolation Pilot Plant
Remote Handled Waste Documented Safety Analysis
and Technical Safety Requirements

U. S. Department of Energy
Carlsbad Field Office

Date: **March 2006**
Revision Number: **DOE/CBFO-06-3334, Rev. 0**

Richard Farrell
Richard Farrell, DOE Review Team Leader

9 March 2006
Date

David C. Moody
David C. Moody, CBFO Manager

3/9/06
Date

Approved: Dae Chung
Dae Chung, Acting Deputy Assistant Secretary
For Integrated Safety Management and Operations Oversight,
U. S. DOE Office of Environmental Management

3/10/06
Date

DOE/CBFO-06-3334

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of the

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Revision 0
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Approved: Dae Chung, Acting Deputy Assistant Secretary — 3/10/06 — Date
For Integrated Safety Management and Operations Oversight,
U. S. DOE Office of Environmental Management

EXECUTIVE SUMMARY

Introduction

This Safety Evaluation Report (SER) documents the Department of Energy's (DOE's) review of Revision 0 of the *Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis*, DOE/WIPP-06-314 (WIPP RH DSA), and the *Remote Handled Technical Safety Requirements,* DOE WIPP-06-3178, and provides the DOE Approval Authority with the basis for approving the document. It concludes that the safety basis documented in the WIPP RH DSA is comprehensive, correct, and commensurate with hazards associated with RH waste disposal operations. The WIPP RH DSA and associated technical safety requirements (TSRs) were developed in accordance with 10 CFR 830, *Nuclear Safety Management*, and DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Safety Analysis Reports*.

The WIPP is managed by the DOE and is designed to permanently dispose of transuranic (TRU) waste from United States nuclear weapons research and production programs. The WIPP is a mined repository located 2,150 feet underground in a stable, ancient salt formation in southeastern New Mexico, 26 miles east of Carlsbad. Site facilities include structures, buildings, and underground excavations.

The DOE was authorized by Public Law 96-164 to provide a facility for demonstrating the safe disposal of TRU wastes from national defense activities and programs of the United States exempted from regulation by the U.S. Nuclear Regulatory Commission. The WIPP was constructed to determine the efficacy of an underground repository for safe disposal of TRU wastes.

Contact-handled (CH) TRU waste disposal operations began March 26, 1999, after the successful demonstration of compliance with applicable federal and state laws and regulations and the completion of the WIPP CH TRU operational readiness review, which verified that the facility was operationally ready and that CH waste disposal operations would be conducted safely at WIPP. Subsequent waste disposal operations have affirmed this.

WIPP waste disposal operations are scheduled to last 35 years. They will consist of receiving, handling, and emplacing radioactive mixed waste in the repository for permanent disposal.

Review and Approval Strategy for the WIPP RH DSA

The WIPP was designed and constructed with provisions for disposing of RH TRU waste, based on the needs of the DOE complex. The WIPP began the process of preparing for receipt and disposition of RH TRU waste, and in January 2003 completed the *Preliminary Safety Analysis Report* (PSAR), DOE/WIPP 03-3174. The CBFO issued a SER in January 2003 documenting the DOE's basis for approving the RH PSAR.

The development of the RH DSA and TSRs followed the approach applied in the currently approved CH DSA and TSRs. DOE Environmental Management (EM) conducted a site visit in September 2004, and as a result major changes were made in Revision 9 of the WIPP CH DSA, including the following.

- The structure and format of the document were revised to be consistent with that used in DOE-STD-3009.
- A new hazard analysis was performed, using a systematic approach, to ensure that all plausible CH hazards were considered.
- New accidents were identified for detailed analysis based on the application of the new hazard analysis.
- The set of controls needed for protection of workers and the public was revised in light of the changes in the CH hazard and accident analyses.
- The CH TSR document was revised to reflect the revised control set; to differentiate between programmatic and specific administrative controls in accordance with DOE-STD-1186-2004, *Specific Administrative Controls*; and to clarify the bases of the various TSRs, as well as the conditions under which TSRs are violated.

The focus of the CH DSA/TSR review was on these changes to ensure that they adequately addressed the EM review team's concerns. Similarly, the RH DSA and TSRs have been developed and revised to address concerns identified and documented in the RH PSAR SER. They have also been revised to be consistent with the CH DSA/TSRs and the concerns previously identified by the EM review team. The RH DSA was developed to be consistent with the DOE-STD-3009 format and with the approved CH DSA. Additional changes incorporated into the RH DSA or considered in the development of the document include the following.

- A new, separate RH hazard analysis was performed, using a systematic approach, to ensure that all plausible and unique RH hazards were identified and considered.
- Only impacts on RH waste were considered for elevation of hazards to accident analysis and in the evaluation of controls for both worker and the public in order to identify any unique RH controls. This was true unless an accident could impact both RH and CH waste; then the impacts on both RH and CH waste were analyzed to determine if any new or additional controls were necessary above and beyond those previously identified in the CH DSA.
- Accidents were identified for detailed analysis based on evaluation of the RH hazard analysis.
- The set of controls needed for protection of workers and the public was developed in light of the RH hazard and accident analyses.
- The RH TSR operations document was developed to reflect the identified control set; to differentiate between programmatic and specific administrative controls in accordance with DOE-STD-1186-2004, Specific Administrative Controls; and to clarify the bases of the various TSRs, as well as the conditions under which TSRs are violated.
- Controls previously functionally classified in the CH DSA were identified to have been classified as such in the RH DSA and were identified at the same level (SC or SS) in the RH DSA even if they were not needed for RH waste hazard evaluation or accident analyses.
- Once RH operations are begun under the RH DSA, the RH and CH DSAs will be combined into a single WIPP DSA and a single set of TSRs during a future annual update process.

This SER and the attendant review were conducted in accordance with Carlsbad Field Office (CBFO) Management Procedure (MP) 4.2, Revision 4, *Document Review*, and with the guidance provided in DOE-STD 1104-96 (Change Notice 3), *Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports*. The SER and review focused on ensuring the comprehensiveness and validity of the revised RH hazard and accident analyses in the DSA and the resulting TSRs. The review team worked closely with Washington TRU Solutions (WTS) during the revisions to the document. A streamlined comment resolution process was employed to allow CBFO input to be provided as the document revision was taking place. This process allowed changes identified early in the process to be efficiently incorporated into this revision in a timely manner. This SER documents a final review of the RH DSA and TSRs following extensive revisions to earlier draft RH DSA and TSR documents.

Results and Conclusions

The conclusion of this SER is that the safety basis analyzed and documented in Revision 0 of the WIPP RH DSA (DOE/WIPP-06-3174) is comprehensive, correct, and commensurate with hazards associated with planned RH waste disposal operations, and that such operations will pose minimal risk to workers, the public, or the environment if conducted within the safety basis documented in this DSA. The hazards associated with RH waste container handling are most significant for the Facility Worker due to the potential external dose exposure. Several RH accidents could result in offsite consequences that challenge or exceed the 25 rem evaluation guideline (EG), thus warranting safety class designation of structures, systems, and components (SSCs) to prevent or mitigate RH accidents. However, since some accidents can involve both RH and CH containers, consequences to the public could challenge or exceed the EG; safety class controls are required for these common events. This is consistent with the current CH DSA evaluations.

A philosophy of prevention is taken with many of the accidents and hazards present at the WIPP. While the prevention of accidents is preferable over mitigation, many if not most hazard and accident prevention is done using specific administrative controls rather than relying on an engineered safety SSC. It is noted that the WIPP site is remotely sited and that on average, the nominal amount of plutonium-239 equivalent curies (PE-Ci) handled in a single CH container has been shown to be conservative by about a factor of five. It is DOE's position that the use of a specific administrative control to protect the public and the worker is adequate for those accidents in which there does not exist an adequate engineered safety feature or a design feature, or the residual risk is qualitatively deemed to be low. Some of the accidents analyzed employ this strategy and, given the remote siting of the WIPP and the conservative public site boundary against which the accident analyses are evaluated, the residual risk is deemed acceptable. This SER documents the DOE's review of Revision 0 of the WIPP RH DSA and provides the DOE Approval Authority with a defensible basis for approving it.

DOE concludes that all WIPP RH TSRs including specific administrative controls are adequately defined and supported by justifiable basis statements and surveillance requirements in accordance with the guidance in DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*. In addition, DOE finds that specific administrative controls have been appropriately differentiated from programmatic administrative controls and have been established in a manner consistent with DOE-STD-1186, *Specific Administrative Controls.*

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ACRONYMS

AA	accident analysis
AC	administrative control
ALARA	as low as reasonably achievable
ARF	airborne release fraction
BDBA	beyond design basis accident
BR	breathing rate
C&C	Consultation and Cooperation
CBFO	Carlsbad Field Office
CH	contact-handled
CUR	Cask Unloading Room
DAR	Document Action Request
DBA	design basis accident
DBE	design basis earthquake
DF	design feature
DCF	dose conversion factor
DID	defense-in-depth
DOE	U. S. Department of Energy
DR	damage ratio
DR/AM	document review/approval matrix
DRR	documented review record
DSA	Documented Safety Analysis
EG	evaluation guideline
EM	Environmental Management
FCLR	Facility Cask Loading Room
FCRD	Facility Cask Rotating Device
FCTC	Facility Cask Transfer Car
GXQ	code used to calculate X/Q
HA	hazard analysis
HERE	Horizontal Emplacement and Retrieval Equipment
LCO	limiting condition of operation
LPF	leak path factor
MHE	mitigated hazard evaluation
MP	management procedure
MSHA	Mine Safety and Health Administration
NCSE	Nuclear Criticality Safety Evaluation
NRC	U. S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PE-Ci	plutonium-239 equivalent curies
PPA	Property Protection Area
RH	remote-handled
SARAH	Safety Analysis and Risk Assessment Handbook
SAC	Specific Administrative Control
SAR	Safety Analysis Report
SARP	safety analysis report for packaging
SC	safety class
SER	safety evaluation report
SMP	safety management program
SR	surveillance requirement
SS	safety significant

SSCs	structures, systems, and components
TRU	transuranic
TRUPACT-II	Transuranic Package Transporter Model II
TSR	technical safety requirement
UHE	unmitigated hazard evaluation
VCE	vapor cloud explosion
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WTS	Washington TRU Solutions
X/Q	atmospheric dispersion factor

1.0 INTRODUCTION

1.1 Safety Evaluation Report Purpose

Pursuant to 10 CFR 830, *Nuclear Safety Management*, the U. S. Department of Energy (DOE) must conduct an independent, defensible review in order to approve a Documented Safety Analysis (DSA). Subpart B, Appendix A, Subsection F of 10 CFR 830 states in particular: "DOE will prepare a Safety Evaluation Report to document the results of its review of the documented safety analysis. A documented safety analysis must contain any conditions or changes required by DOE." That review and the DSA/Technical Safety Requirement (TSR) approval bases are documented in this Safety Evaluation Report (SER). This SER documents the DOE's review of the *Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis*, DOE/WIPP-06-3174, Rev. 0 (WIPP RH DSA) and the *Remote Handled Technical Safety Requirements*, DOE WIPP-06-3178, and provides the WIPP RH DSA/TSR Approval Authority with the basis for their approval.

1.2 Facility Identification, Background, and Mission

The Waste Isolation Pilot Plant (WIPP), which is administered by the Carlsbad Field Office (CBFO), is designed to permanently dispose of transuranic (TRU) waste from United States nuclear weapons research and production. The WIPP is located in southeastern New Mexico, 26 miles east of Carlsbad, NM. Facilities include surface structures, disposal rooms, and other excavations mined 2,150 feet beneath the earth's surface in a stable, ancient salt formation.

The DOE was authorized by Public Law 96-164 to provide a facility for demonstrating the safe disposal of TRU wastes from national defense activities and programs of the United States exempted from regulation by the U.S. Nuclear Regulatory Commission (NRC). The WIPP was constructed to determine the efficacy of an underground repository for safe disposal of TRU wastes.

Development of the WIPP began in the early 1970s with a siting phase. During the siting phase, several potential sites were evaluated. The present site was selected based on extensive geotechnical research supplemented by testing. At the conclusion of the site and design validation and the construction phases, the DOE proposed a test phase to be followed by the waste emplacement and disposal phase. The test phase was to involve the use of limited quantities of contact-handled (CH) TRU waste to conduct tests in the WIPP repository to provide data for reducing the uncertainties in the performance assessment required for compliance with the long-term waste isolation regulations of the U.S. Environmental Protection Agency found in Subpart B of 40 CFR Part 191.

As a result of a major program redirection in late 1993, the WIPP test phase was modified by replacing the previously planned WIPP underground radioactive tests with laboratory tests. Thus, WIPP operations were scheduled to proceed directly with the disposal phase. CH TRU waste disposal operations began on March 26, 1999, after the successful demonstration of compliance with applicable federal and state laws and regulations and the completion of the WIPP CH TRU operational readiness review.

The disposal phase is projected to last 35 years. It will consist of receiving, handling, and emplacing TRU waste in the repository for permanent disposal.

The WIPP was originally designed and constructed to handle both CH and RH TRU and mixed TRU waste; however, during the original permitting process for the WIPP, the New Mexico Environment Department provided comments on the draft permit that: "The Permittees shall not store or manage TRU waste in the RH Bay of the Waste Handling Building Unit or dispose of any RH waste in any HWDU unit until: (a) The Permittees obtain a modification for the methods for characterizing RH waste under the WAP and (b) The Permittees obtain a Permit modification for the procedures for the storage and management of RH waste in the RH Bay." Prior to accepting any RH TRU mixed waste at WIPP, the facility must clear the regulatory hurdle of obtaining an acceptable permit modification. In addition, the WAP and other facility operating modifications must be included and submitted as a modification to the existing Hazardous Waste Facility Permit to allow storage and disposal of RH TRU mixed waste. The current permitting action including the draft Permit responds to all of these issues and the resulting final Permit is expected to contain the conditions necessary to allow for characterization, storage, and disposal of RH TRU mixed waste.

1.3 Facility Hazard Classification

The hazard classification was determined in accordance with DOE Standard DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. A deterministic approach was taken without considering facility segmentation, form, location, or dispersibility of the material at risk. The material at risk for the determination of the hazard category was defined as the maximum potential radiological content of a single RH or CH waste container. The WIPP is classified as a Hazard Category 2 facility based on either waste container inventory, in comparison to the threshold quantities provided in DOE-STD-1027-92.

1.4 WIPP Documented Safety Analysis History and Approach

The WIPP Safety Analysis Report (SAR) was originally issued in May 1990 to support the test phase and subsequent CH waste disposal operations at the facility. This followed approval by the DOE Office of Environmental Restoration and Waste Management. It satisfied (1) the commitments in the Working Agreement for Consultation and Cooperation (C&C Agreement) between the State of New Mexico and the DOE, and (2) the requirements of DOE Order 5481.1B, *Safety Analysis and Review System*. The DOE Office for Safety, Health and Quality Assurance (EH-30) prepared a SER (DOE/CAO-97-1224, Rev. 0) to document the DOE's review of, and approval basis for, the original WIPP SAR (May 1990).

The WIPP CH SAR was modified significantly during the FY95 annual update (DOE/WIPP-95-2065, Rev. 0). Subsequent annual updates continued to incorporate administrative and facility changes into the SAR and ensure it was kept current. The DOE began disposing of CH waste at WIPP in March 1999, within the safety basis documented in Revision 3 of the CH SAR (DOE/WIPP-95-2065, Rev. 3). Significant modifications were incorporated in Revision 5 of the CH SAR to ensure its compliance with 10 CFR 830. In light of the significance of these changes, the DOE decided that a complete revision of the SER was warranted. That revision

(DOE/CBFO-97-1224, Rev. 1) satisfied the requirements for documented safety analysis review and approval in accordance with Subpart B, Appendix A, Subsection F of 10 CFR 830.

Further revisions were made during each annual review of the CH SAR to reflect changes in facility operations and changes in regulations and associated standards and guidance. The SAR was re-titled *WIPP Contact handled (CH) Documented Safety Analysis* in Revision 8 to reflect current 10 CFR 830 terminology. Each of these revisions was approved by an addendum to Revision 1 of the SER.

In September 2004, a team from the DOE-EM Office of Licensing performed an assessment of the WIPP safety basis documentation. Based on observations by the assessment team, a number of major changes were made to the FY 2005 revision of the WIPP CH DSA (DOE/WIPP-95-2065, Rev. 9). Due to the significance of these changes, it was decided that a new SER should be prepared in lieu of another addendum. This SER (DOE/CBFO-97-1224, Rev. 2) was thus prepared to document the approval of Revision 9 of the WIPP CH DSA.

In January, 2003, a RH Preliminary Safety Analysis Report (PSAR), DOE/WIPP 03-3174, was developed by Washington TRU Solutions (WTS). The DOE CBFO conducted a review and a SER was prepared to document the approval of the WIPP RH PSAR.

The safety basis for handling and emplacement of RH TRU waste for disposal at the WIPP established and analyzed in Revision 0 of the RH DSA consists of management, design, construction, operation, and engineering characteristics necessary to protect the public, workers, and environment from the safety and health hazards posed by RH waste disposal operations. The WIPP RH DSA includes an analysis of hazards associated with normal remote handling operations, external events, and natural phenomena, as well as a detailed evaluation of the consequences resulting from design basis and beyond design basis accident (BDBA) scenarios. The analyses are conducted separate from Revision 9 of the WIPP CH DSA, except where the potential for a combination of RH and CH waste may be affected by a common accident, accident progression, or a single initiator.

The hazard analysis technique used in the RH DSA is similar to that previously used in the CH DSA and employs a hybrid approach incorporating elements of the What-If/Checklist and Preliminary Hazard Analysis methods that qualitatively rank hazards by likelihood and significance of consequence. Hazards were systematically identified and assessed to evaluate the potential operational, external, and natural phenomena events that can cause the identified hazards to develop into accidents. Subsequently, the consequences of accident scenarios identified in the hazard assessment were quantitatively analyzed.

In evaluating hypothetical accidents, conservative assumptions were generally made to provide bounding consequences. These include, but are not limited to, conservative values for frequency estimates, container inventory, material at risk, damage ratio, leak path factor, and air transport modeling assumptions. The use of conservative assumptions to bound the full range of possible accident scenarios provides reasonable assurance that (1) the safety envelope of the WIPP facility is defined; (2) the design of the facility is adequate in response to the accident scenarios analyzed; and (3) the TSRs assigned will provide satisfactory protection of the public, workers, and environment.

For the purpose of safety analysis, the WIPP is a radioactive/hazardous materials handling/storage and disposal facility. There are no complex systems or processes involved in current or planned waste disposal operations, and no identified energy sources are available to disperse materials in the event of an accident. Consequently, material handling accidents involving RH TRU and in some cases RH and CH TRU waste are the dominant accident scenarios or mechanisms analyzed in the WIPP RH DSA.

2.0 DSA/TSR REVIEW PROCESS

The WIPP RH DSA/TSR review was performed in accordance with CBFO Management Procedure (MP) 4.2, Revision 3, *Document Review,* by a team composed of DOE personnel from CBFO and contract personnel from the CBFO Technical Assistance Contractor (CTAC) who are technically qualified in the subject matter. Review team members with the required qualifications were selected by senior CBFO management in accordance with CBFO MP 4.4, Revision 4, *Document Preparation and Control.* The CBFO Safety Officer performed the role of review team leader. The review team leader is responsible for performing a defensible, independent review of the WIPP RH DSA and TSRs. The CBFO Authorization Basis Senior Technical Advisor served as senior advisor for the review. Other CBFO and CTAC staff members completed the review team. Specified members of CBFO and CTAC staffs were delegated by CBFO review team members to review certain portions of the DSA and TSRs, based on their respective qualifications and areas of interest or responsibility.

All review team members have degrees in the physical sciences or engineering, and experience in safety analysis methodology and applications. Collectively, the review team members have training and experience in radiation protection, nuclear safety, nuclear criticality analysis, industrial safety and hygiene, mine safety, and conduct of operations.

The review establishing the DOE's approval basis for the WIPP RH DSA and TSRs was performed by the DSA review team to provide the Approval Authority the justification for approving the document. It was conducted in accordance with the guidance provided in DOE-STD-1104-96 (Change Notice 3), *Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports.* Details of the DOE's approval basis review of the WIPP RH DSA and TSRs, including conclusions, are documented in this report.

The review process reported in this SER consisted of iterative reviews and comment resolution meetings between the review team and the WTS Nuclear Safety Group, the authors of the document. Those reviews and meetings resulted in discussion of issues, development and resolution of formal comments, and resulting revisions to the draft RH DSA. The development of Revision 0 of the WIPP RH DSA and TSRs was accomplished by WTS as the management and operating contractor, but the review and comment resolution process was interactive, with extensive discussions among the DSA/TSR authors and the review team.

3.0 WIPP RH DSA FORMAT

Revision 0 of the RH DSA follows the 17-chapter format and structure provided in DOE-STD-3009.

4.0 APPROVAL BASES

DOE's review of the safety basis established in Revision 0 of the WIPP RH DSA and the TSRs for RH TRU waste disposal operations consists of the review team's assessment of five key bases of DSA information, which are listed below:

Basis	DSA Chapters and Other Documentation
1. Base Information	Executive Summary, Chapter 1 (Site Characteristics), Chapter 2 (Facility Description).
2. Hazard and Accident Analysis	Chapter 3 (Hazard and Accident Analysis)
3. Safety Structures, Systems, and Components	Chapter 4 (Safety Structures, Systems, and Components)
4. Derivation of Technical Safety Requirements	Chapter 5 (Derivation of the Technical Safety Requirements and the TSR document)
5. Safety Management Program Characteristics	Chapters 6-17 covering management and programmatic considerations related to the assurance of safe operations.

Revision 0 of the WIPP RH DSA was reviewed for adequacy in relation to each basis listed above with primary emphasis placed on Chapters 2, 3, 4, 5 and the TSRs since much of the information contained in other chapters of the RH DSA would be expected to be very similar to complementary chapters contained in the approved CH DSA. The focus of the review was on bases 2 (Hazard and Accident Analysis), 3 (Safety Structures, Systems, and Components), and 4 (Derivation of Technical Safety Requirements and the TSR document). The other bases were reviewed to ensure consistency throughout the document. This SER summarizes the results and conclusions of the DOE's review.

4.1 Base Information

DOE-STD-1104-96 recommends that DSA base information be evaluated with regard to sufficiency to allow assessment of the other approval bases that rely on base information. Also, the guidance recommends that a SER's statement of adequacy of base information be focused and brief. The DOE's review of base information DSA chapters found that the WIPP RH DSA contains sufficient background and fundamental information to support the review of the remaining four approval bases, the more technical aspects of the review.

The base information included in the WIPP RH DSA is complete and documented in accordance with the requirements of 10 CFR 830, Subpart B, and DOE-STD-3009-94. The WIPP RH DSA segregates base information into two categories: (1) a detailed description of the physical site where the surface structures and underground excavations are or will be situated, and (2) a detailed description of facility design and operations. The base information provided in the WIPP RH DSA is sufficient to select the Hazard Category classification of the facility, analyze hazards and postulated accidents, and derive appropriate TSRs to ensure safe operations. The safety basis established in the WIPP DSA is supported by accurate, complete base information.

Because of the nature of the WIPP facility, site characteristics have been thoroughly studied. The WIPP is a first-of-a-kind facility designed to permanently dispose of transuranic waste from United States nuclear weapons research and production programs. Conventional site characteristics have been carefully studied, as well as geological and hydrological aspects of the WIPP site related to disposal of waste in the Salado Formation. The studies have included thorough, independent oversight and public scrutiny covering more than 20 years. The WIPP RH DSA includes a detailed summary of many of those studies, resulting in a thorough description of site characteristics provided in Chapter 1.

Chapter 2 of the WIPP RH DSA discusses the design of the facility and the design and operation of remote process waste handling equipment. It also describes the RH waste handling process. This information provides the foundation upon which to base the hazard and accident analyses discussed in Chapter 3.

The WIPP facility includes surface support buildings, a waste handling building, four mine shafts, and the mined underground operations and waste disposal areas. The waste disposal operations are not complex. They primarily involve receiving, handling, and transporting to underground disposal rooms sealed containers holding radioactive mixed waste. Waste is handled and emplaced as received from generator sites. The CH and RH waste disposal operations share segments of the WIPP facility and can be conducted concurrently. Therefore, where the CH DSA and RH DSA overlap, they are consistent and in agreement. No waste characterization or processing is performed at WIPP. Any required waste characterization or processing activities are conducted at waste generator sites before the waste is transported to WIPP.

4.2 Hazard and Accident Analyses

Hazards associated with normal WIPP operations include mining dangers, rotating machinery, high voltage, compressed gases, confined spaces, radiological and non-radiological hazardous materials, ionizing and non-ionizing radiation, high noise levels, mechanical and moving equipment dangers, working at heights, construction, and material handling dangers. Waste handling operations at the WIPP do not involve high temperature and pressure systems, or electromagnetic fields. DOE-prescribed Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) standards regulate routine occupational hazards.

Hazard analysis for the WIPP RH DSA consisted of hazard identification followed by hazard evaluation. During hazard identification, information was gathered about the various process hazards that might lead to accident scenarios. The information gathering process included physical walk-downs, information walk-downs, and discussions with subject matter experts. The physical walk-down, guided by WIPP facility experts, consisted of a comprehensive tour of the RH waste handling areas, and included detailed discussions of the layout and activities conducted in those areas. Information walk-downs included a review of the available facility description and inventory information, supporting operational safety studies, and consultations with system engineers and process experts. The information gathering process resulted in a comprehensive list of potential facility hazards, which was then screened to eliminate standard

industrial hazards, which are not considered in DSA hazard and accident analyses except where they may be initiators for a release of radioactive or hazardous material.

The hazard evaluation process consisted of an unmitigated hazard evaluation (UHE), in which hazard-initiated events were qualitatively evaluated for frequency and consequences without the benefit of preventive or mitigative controls, and a mitigated hazard evaluation (MHE), performed to demonstrate that adequate preventive and mitigative features were selected to reduce the unmitigated event risk to the on-site and facility worker groups. The results of the UHE were used to identify the events that require further evaluation in the MHE for events posing significant risk to workers and in accident analysis for events posing a significant risk to the public. Accident analysis results were compared to the Evaluation Guideline (EG) to determine the need for safety class structures, systems, and components (SSCs) or administrative controls to protect the public. The MHE resulted in selection of controls for the protection of on-site and facility workers.

Defense-in-depth (DID) considerations were integrated into this process using the following philosophy:

> *DID as an approach to facility safety has extensive precedent in nuclear safety philosophy. It builds in layers of defense against release of hazardous materials so that no one layer by itself, no matter how good, is completely relied upon. This includes protection of the barriers to avert damage to the plant and to the barriers themselves. It includes further measures to protect the public, workers, and the environment from harm in case these barriers are not fully effective. The first layer of DID involves barriers to contain uncontrolled hazardous material or energy release. The second layer of DID involves preventive systems to protect those barriers and the third involves systems to mitigate uncontrolled hazardous material or energy releases upon barrier failure.*

In the RH DSA, DID is described as it pertains to 5 areas of the WIPP process:

- Waste handling above ground prior to moving 10-160Bs and 72Bs into the WHB
- Waste handling inside the WHB
- Waste hoist operations
- Waste handling underground prior to panel or room closure
- After panel closure

DOE finds that the hazard analysis approach described above is consistent with the guidance provided in DOE-STD-3009-94 and represents a proper application of the graded approach to a facility of the type and complexity of WIPP.

Events determined through the UHE to require accident analysis were grouped into the following categories: fires, explosions, loss of containment or confinement, nuclear criticality, external hazards (e.g., airplane crashes, pipeline explosions) and natural phenomena (e.g., earthquakes, tornadoes). Those accidents determined as a result of quantitative accident analysis to result in unmitigated consequences exceeding or challenging the 25 rem EG included: fires in the upper hot cell, crane maintenance room, and the hot cell operating gallery; fires in the underground

along the disposal path or in the vicinity of the CH waste face array; several container explosions that resulted in ejection of some contents and unconfined burning; RH vehicle collision into the CH waste array; RH vehicle drives into waste shaft, impacting CH waste; seismic with fire; and an external fire propagates into the Waste Handling Building.

In September 2004, a team from the DOE-EM Office of Licensing performed an assessment of the WIPP safety basis documentation. Based on observations by the assessment team, a number of major changes were made to the hazard and accident analyses in the WIPP CH and subsequently the Rev. 0 RH DSA and to the associated TSR documents. The structure and format of the documents were revised to adhere to that used in DOE-STD-3009. As explained in Section 3.0, previous revisions of the WIPP CH DSA contained all the content required by DOE-STD-3009, but presented it in a 10-chapter format that had been agreed upon between CBFO and the State of New Mexico. Although a crosswalk was originally provided to show equivalency in the CH SAR and subsequent DSA revisions, the use of the non-standard format caused confusion during reviews and made it more difficult to trace the selection of accidents for quantitative analysis and the development of controls. Changing both the CH and RH documents to the 17-chapter format of DOE-STD-3009 has alleviated these problems and simplified the presentation of hazard and accident analysis results and their relationship to control selection and TSR development.

A new hazard analysis was performed for the RH DSA, using a systematic approach, to ensure that all plausible hazards were considered. An earlier RH hazards analysis developed for the January 2003 RH PSAR was used as a starting point for the above. The new hazard analysis uses a methodology suitable for a facility of the type and complexity of WIPP. It employed a methodology consisting of a combination of the What If/Checklist and Preliminary Hazard Analysis methods. This allowed for a comprehensive consideration of potential hazards and events.

New accidents were identified in both CH and subsequent RH analyses and added for detailed analysis based on the application of the new hazard analysis. These included explosions in waste containers, explosions external to waste containers, vehicle crash into the WHB, vehicle crash through the RH bay wall into stored CH waste, lightning strike to the WHB, fires outside the WHB propagating to the WHB, snow/ice loading causing the WHB roof to collapse, hot cell explosions and fires, hot cell loss of confinement due to handling errors, and worker overexposure due to hot cell operations. The new hazard analysis resulted in a change in the types of accidents resulting in the highest consequences.

The set of controls needed for protection of workers and the public was revised in light of the changes in the hazard and accident analyses. New controls were identified and some previous controls were elevated from defense-in-depth or balance of plant level controls to safety class or safety significant controls. This updated suite of controls will enhance the safety of workers and the general public.

The RH TSR document was developed to reflect the control set identified in Chapter 3, to differentiate between programmatic and specific administrative controls in accordance with DOE-STD-1186-2004, *Specific Administrative Controls*, and to clarify the bases of the various

RH TSRs as well as the conditions under which they are judged to be violated. These have resulted in a set of TSRs that better reflect the RH operating realities of the facility.

DOE's review of Chapter 3 of the WIPP RH DSA concludes that the hazard and accident analyses are consistent with the approach outlined in DOE-STD-3009-94, are appropriate for a facility of the type and complexity of WIPP and, with the incorporation of the changes listed above, provide a well-defined and supportable safety basis that will result in the continued safe operation of the facility. Specifically, DOE finds that the analyses of Chapter 3:

- Systematically and comprehensively identify the potential hazards resulting from normal WIPP RH waste disposal operations,
- Effectively evaluate those hazards with regard to operational, external, and natural phenomena events that could develop into accidents,
- Assess associated preventative and mitigative features for defense-in-depth and worker safety and the selection of safety significant controls,
- Evaluate postulated accident consequences against the EG to identify needed safety class controls, and
- Effectively translate identified controls into TSRs.

DOE notes that the calculation of accident dose as a product of material at risk (MAR), damage ratio (DR), airborne release fraction (ARF), respirable fraction (RF), leak path factor (LPF), atmospheric dispersion factor (X/Q), breathing rate (BR) and dose conversion factor (DCF) is consistent with the methodology suggested in DOE-STD-3009-94, Appendix A, and the methodology applied in the CH DSA. DOE also finds that the selection of values for ARF and RF are consistent with those found in DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, and that DR values selected are supported by referenced documentation. Values for LPF are conservatively selected to be 1.0 for all cases. The selection of MAR for each accident scenario is scenario-dependent and is well supported by a calculation package referenced in the DSA. DOE notes that the air transport/dispersion code used to calculate X/Q values (GXQ) is not one of those included in the DOE Toolbox. However, DOE-STD-3009-94 requires only that the code used be consistent with NRC Regulatory Guide 1.145 and that it be appropriately documented in accordance with software quality assurance requirements. Since the GXQ code meets both of these requirements, DOE concurs with its use.

For flammable pool fires engulfing drums and potential internal drum explosions, the source term for unconfined burning of the ejected portion (i.e., 5% of the drum content is ejected and 20% burns) is based on a conservative assumption that the waste is all combustible, consisting of 50% cellulose (i.e., 1E-2 ARFxRF) and 50% contaminated plastics (i.e., 5E-2 ARFxRF, or a weighted value of 3E-2 ARFxRF. DOE believes that this assumption is sufficiently conservative because: (1) the known characterization of RH and CH wastes to be received at WIPP do not indicate that any waste streams are all plastics Title 40 CFR 191 Subparts B & C, compliance recertification application 2004, Appendix data, attachment); and (2) assuming the worst case of all plastics with the 5E-2 ARFxRF would not derive additional TSR-level controls.

Finally, DOE notes that several accidents in the WHB or the underground, as summarized on Table 3.4-1 of the RH DSA, warrant designation of safety class SSCs or development of TSR specific administrative controls (SACs). A detailed review of the analyses by the review team concluded that it is very conservative and results in an adequate TSR control set to protect the public, onsite workers, and facility workers. However, based on the lack of available fuel in some areas of the WHB where pool fires are modeled, and the lack of detail supporting conservative assumptions related to flammable gas explosions in the WHB, there is an opportunity for improvement to be more consistent with respect to establishing TSR controls.

Underground fires involving RH containers were modeled based on the diesel-fuel hazard associated with material handling equipment. The source term modeling assumptions were consistent with those applied for the CH DSA Revision 9 addressing the potential ejection of combustible waste from drums. RH DSA fires in the WHB hot cell, operating gallery, and maintenance room were modeled with the same pool fire with ejection assumption. This modeling assumption was made because fuel could theoretically be introduced into these areas of the WHB. This is a very conservative assumption since these (flammable) liquids are not needed to support operational or maintenance needs. Therefore, DOE notes that it is appropriate to model WHB fires in the hot cell areas without the pool fire assumption, provided that it is identified as an initial condition in the analysis with protection in the TSRs. This type of accident would not likely challenge the Evaluation Guideline as it is conservatively estimated in the proposed DSA. However, the TSR controls would be the same, that is, a need for a TSR control prohibiting large quantities of flammable or combustible liquids when waste containers are present.

For a flammable gas (cylinder leak) vapor cloud explosion (VCE) in a WHB room, the RH DSA simply assumes that the pressure/shock wave from the explosion results in an impact-type release from 10 drums and 6 facility canisters with a 1.0 Damage Ratio (DR), an Airborne Release Fraction (ARF) of 1E-3 and Respirable Fraction (RF) of 1.0. It also assumes an additional release from an ensuing fire. This is a bounding assumption that results in a conservative estimate of consequences. The DOE Review Team notes that a mechanistic evaluation that considers room dimensions and the actual potential overpressures and extent of waste container damage would likely justify a lesser DR and RF of 0.1 per section 5.2.3.2 of DOE-HDBK-3010. An example of this type of modeling is presented in the Rocky Flats *Safety Analysis and Risk Assessment Handbook* (SARAH). In the absence of very large ignition source, all VCEs are deflagrations with a uniform pressure increase in a room that may or may not cause a waste container release depending on the size of the room and structural response of the construction materials. A 55-gallon waste container has been calculated to withstand much greater crushing pressures than those at which typical room construction features would fail (SARAH).

Therefore, justification for a lower DR (e.g., Rocky Flats DSAs assumed 0.1) is possible for the damage from falling debris/equipment. The potential for transition to detonation also needs to be considered. The conditions associated with deflagration-to-detonation transition are complex, but may be used to justify various DRs based on room size and number and size of obstacles in the room, with the conditions differing substantially for different flammable gases. A third phenomenon evaluated in the Rocky Flats SARAH is a turbulent jet detonation whose damage

zone is a function of distance from the center of the explosion and may not affect all the containers present (i.e., again a lower DR).

The more mechanistic modeling will result in a sufficiently conservative analysis but with potentially smaller release estimates and dose consequences.

Chapter 3 provides the primary bases to support the conclusion that RH TRU waste disposal operations can be conducted safely at the WIPP. To ensure the safe operation of the facility, RH waste disposal operations must be conducted within the safety envelope defined by the analyses provided in this chapter and implemented through the resulting RH TSRs.

4.3 Safety Structures, Systems, and Components

Safety SSCs include safety class (SC) SSCs and safety significant (SS) SSCs. Safety-class SSCs are defined in DOE-STD-3009-94 as "structures, systems, or components including portions of process systems, whose preventive and mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from the safety analyses." Otherwise stated, SC SSCs are those SSCs whose preventive and/or mitigative function is necessary to keep radiological exposure to the public from exceeding or challenging the off-site evaluation guideline. The guideline specifies that a value of 25 rem (roentgen equivalent man) total effective dose equivalent to a maximally exposed member of the public be used as the threshold for identifying SC SSCs. In accordance with the accident analysis results in Chapter 3 of the CH DSA, the WHB, the waste handling equipment automatic fire suppression systems, and the waste hoist structure and structural support, including the waste hoist head frame, waste shaft conveyance, counterweight, ropes, waste hoist drum, and structural support provided by the waste hoist tower, are designated safety-class. As a result of the analysis conducted in the RH DSA, three additional safety class systems were identified: automatic fire-suppression on RH waste handling equipment, the WHB structure including hot cell concrete walls, floors, ceiling, oil filled lead glass windows and steel doors, and the waste hoist brakes. The safety function of the RH waste handling equipment automatic fire suppression systems is to extinguish vehicle fires associated with fuel line leaks and the vehicle engine, thus preventing small fires from becoming large fires in the underground. The safety function of the RH unique hot cell and its associated noncombustible construction is to prevent fire propagation and to protect waste stored or being handled inside the hot cell from fires. The safety function of the waste hoist brakes is to prevent the drop of vitrified waste while on the waste hoist conveyance.

Safety-significant SSCs are defined as those SSCs not designated as safety class, but whose preventive or mitigative function is a major contributor to defense-in-depth and/or worker safety as determined from safety analyses. As discussed in DOE-STD-3009-94, safety-significant SSCs based on worker safety are limited to those SSCs whose failure is estimated to quickly result in worker fatality or serious injury or significant radiological or chemical exposure to workers.

The RH DSA has identified the following safety significant SSCs, along with their noted safety functions, as a result of the analyses in Chapter 3. Only those identified in the course of the RH DSA analyses are presented here. Other SS SSCs and/or functions are presented in the CH DSA.

Fire Water and Fire Suppression Systems – prevent small fires from becoming large fires and extinguish fires before they become large enough to impact RH waste, propagate to areas where RH waste may be outside a shipping cask, or propagate from the RH portion to the CH area of the WHB and impact CH waste.

Waste Handling Building Hot Cell Complex – provide shielding for worker protection and the structural beams in the upper hot cell provide support to prevent waste canisters from falling into the lower hot cell.

RH Bay Crane, Upper Hot Cell Crane and Overhead Powered Manipulator, Cask Unloading Room (CUR) Crane, Facility Cask Loading Room (FCLR) Grapple Hoist and Waste Hoist – must be designed to hold their loads during a design basis earthquake (DBE) or loss of power.

Upper Hot Cell Crane Grapple and FCLR Grapple Hoist Grapple – must be capable of structurally supporting a canister or lift fixture associated with moving lift fixtures or drum carriages and prevent dropping waste or items on waste during DBE or loss of power.

Paved or Graveled Property Protection Area (PPA) Surrounded by Gravel Road – provide physical separation between the WHB and low profile indigenous vegetation surrounding the WIPP site to prevent wild land fire propagation into the WHB.

Upper Hot Cell Canister Storage Wells – provide structural support for facility canisters in the upper hot cell to prevent impact with other canisters in the hot cell. Also prevent direct flame impingement on facility canisters and protect canisters from dropped objects.

Underground Ventilation – must be operating to ensure that in the event of a waste container breach, airflow is directed away from workers and towards the disposal array. Underground ventilation also ensures there is sufficient airflow to facilitate evacuation of underground workers in the event of underground fires.

Transfer Cell Shuttle Car – required to support maximum design load and remain on rails during DBE.

Upper Hot Cell Wall Mounted Manipulators – counterweights limit speed of travel to prevent breaking upper hot cell shield windows leading to a loss of worker shielding.

Underground Bulkheads, Overcasts, and Airlocks – provide separation in the underground between construction ventilation circuit and disposal circuit and waste shaft station and prevent fire propagation from the construction areas into the waste storage areas.

Boreholes and Borehole Shield Plugs – provide worker shielding after RH canister disposal in waste borehole; maintain criticality spacing and placement assumptions.

WHB Shielding Interlocks – CUR Shield Door, Upper Hot Cell Shield Plugs and Upper Hot Cell Crane – provide worker shielding in the CUR while processing a 72B waste canister and waste is in the upper hot cell. Also provides worker shielding when removing waste from a

10-160B in the CUR or when items are being transferred between the CUR and upper hot cell while waste is in the upper hot cell.

FCLR Telescoping Port Shield and Grapple Hoist Shield Bell – provide shielding for worker protection when positioned vertically over the transfer port between the transfer cell and FCLR.

WHB Interlocks (FCLR Grapple Hoist and Shield Bell, Telescoping Port Shield, Facility Cask, and Transfer Cell Ceiling Shield Valve) – ensure that an RH waste canister cannot be raised into the FCLR using the FCLR grapple hoist unless the facility cask is located over the transfer port between the transfer cell and the FCLR and positioned in a vertical configuration such that the FCLR grapple hoist shield bell can mate with the top of the facility cask and the telescoping port shield can mate with the lower part of the facility cask. The interlocks also prevent closure of the facility cask shield valves or transfer cell ceiling shield valves on the grapple hoist ropes or waste canister to prevent dropping or crushing a waste canister.

WHB Interlocks (FCLR Grapple Hoist and Shield Bell, Telescoping Port Shield, Facility Cask, and Facility Cask Rotating Device) – prevent the vertically positioned cask from rotating until transfer of a canister is complete and the telescoping port shield, shield bell and grapple are fully retracted.

WHB Interlocks (Transfer Cell Shuttle Car, CUR Shield Valve, Upper Hot Cell Shield Valve, and Transfer Cell Ceiling Shield Valve) – prevent an RH canister from being breached as a result of a drop due to shuttle car movement shearing the ropes or the crane or grapple performing the transfer. Also prevents crushing a waste canister during transfer between the CUR and the transfer cell or the transfer cell and the facility cask in the FCLR.

Horizontal Emplacement and Retrieval Equipment (HERE) and Shield Collar – provide worker shielding when mated with the facility cask during waste transfer from the facility cask into the borehole. Also prevents direct flame impingement on the RH canister as well as protecting the canister from explosions during waste transfer from the facility cask into the borehole.

Underground Interlocks (HERE, Facility Cask, and Shield Collar) – ensure worker shielding during waste transfer from the facility cask into the borehole and prevent crushing a canister by detecting misalignment or a gap in shielding of the HERE with respect to the borehole. Also prevents closing the facility canister shield valves on the RH canister during waste transfer from the facility cask into the borehole.

RH Metal Facility Canisters – contains a pinned lid with a pintle capable of structurally supporting the canister during lifting. Also prevents direct flame impingement on RH drums loaded into a facility canister, as well as lid ejection during a fire.

RH Facility Cask – provides worker shielding from RH waste contained within the cask. Prevents direct flame impingement on waste canisters during fires and protects waste canisters from explosions and drops.

Facility Cask Transfer Car (FCTC) – structurally supports the facility cask during transfer of a RH waste container from the transfer cell to the facility cask and subsequent transfer to the underground on the waste shaft conveyance. The FCTC also mates with the Facility Cask Rotating Device (FCRD) and latches to prevent the FCTC from moving during canister transfer that could result in crushing the RH waste canister or FCLR grapple hoist and ropes and dropping a canister. This feature also prevents loss of shielding in the FCLR.

Waste Shaft Collar Fence – to define the restricted area surrounding the waste shaft and prevent uncontrolled access to the shaft.

DOE's review of the information in Chapter 4 of the RH DSA, as summarized above, reveals that the designation of these SSCs as safety class and safety significant follows directly and logically from the information developed in the hazard and accident analyses in Chapter 3 of the RH DSA. In accordance with DOE-STD-3009-94, Chapter 4 of the DSA also describes the safety function, functional requirements, and system evaluation for each of the safety SSCs. DOE has reviewed these descriptions and agrees that they adequately describe the operational requirements for each of these safety SSCs and how these requirements have been incorporated in the design of the respective SSCs to allow them to perform their required safety functions.

4.4 Derivation of Technical Safety Requirements

The purpose of Chapter 5 of the DSA is to derive the TSRs that build upon the control functions determined to be essential in Chapter 3, Hazard and Accident Analysis, and Chapter 4, Safety Structures, Systems, and Components. This chapter consists of summaries and references to pertinent sections of the RH DSA in which design features (DFs) and administrative controls (ACs) are needed to prevent and/or mitigate the consequences of a postulated event. The limiting conditions for operation (LCOs), surveillance requirements (SRs), and necessary ACs determined in this chapter form the basis for the facility TSRs and provide the logical link between the TSRs and the DSA.

Review of the information in Chapter 5 of the RH DSA provides assurance that TSR coverage for the WIPP is complete. The TSR controls logically flow from the safety functions outlined in Chapters 3 and 4 of the RH DSA and ensure that the safety functions are operational and preserve the Initial Conditions. Chapter 3 identifies the controls necessary to prevent and/or mitigate potential hazardous events evaluated in this DSA. Chapter 4 identifies which SSCs are SC and SS for RH operations at WIPP. The safety SSCs and ACs identified in Chapter 3 are required to prevent and/or mitigate postulated events within WIPP and, therefore, they are evaluated for TSR coverage.

The Hazard Analysis (HA) and Accident Analysis (AA) take credit for the identified controls in one of two ways: (1) the controls are assumed to function as intended to reduce the frequency and/or consequences of (or prevent) a higher risk event, in which case they are passed to the TSRs as SSCs (active SSC or passive DF) or TSR AC; or (2) they are considered secondary defense-in-depth controls. This review has verified that all SSCs and ACs credited with prevention and/or mitigation in the AA and those required for worker protection have been incorporated into the TSRs via the derivations provided in Chapter 5.

All TSRs derived in Chapter 5 are in the form of Limiting Conditions of Operation (LCOs) or ACs (specific or programmatic). The discussions in Chapter 5 justify the fact that no Safety Limits or Limiting Control Settings are needed due to the nature of WIPP operations, and none have been specified. DOE concurs with this analysis and agrees that all controls are appropriately specified as LCOs or ACs.

4.5 Safety Management Program Characteristics

Safety management programs (SMPs) provide the basis for the TSR programmatic controls that help to ensure defense-in-depth and worker safety. These SMPs are described in Chapters 6 through 17 of the RH DSA and are summarized as follows.

Criticality Safety Program (DSA Chapter 6) – ensure worker safety by prevention of inadvertent criticality associated with waste handling, storage, and emplacement operations.

Radiation Protection Program (DSA Chapter 7) – provide protection to workers and the off-site public from radiological hazards associated with the storage and emplacement of RH TRU and RH TRU mixed waste, including maintaining worker exposures As Low As Reasonably Achievable (ALARA).

Hazardous Material Protection Program (DSA Chapter 8) – protect workers and the off-site public from non-radiological hazardous material exposures resulting from RH waste operations, including the occupational health program for monitoring and medical services for workers.

Radioactive and Hazardous Waste Management Program (DSA Chapter 9) – manage site-derived and site-generated radioactive and hazardous wastes in a manner consistent with the protection of the workers, the public, and the environment.

Initial Testing, In-Service Surveillance, and Maintenance Programs (DSA Chapter 10) – ensure that all SSCs, and especially safety SSCs, meet their functional and performance requirements described in the DSA as necessary for protection of worker and off-site public safety.

Operational Safety Program (DSA Chapter 11) – provide for the orderly and proceduralized day-to-day operation (including conduct of operations and fire protection) of the WIPP facility in a manner designed to protect workers from radiological and hazardous chemical exposures, and from standard industrial hazards.

Procedures and Training Programs (DSA Chapter 12) – protect the assumptions in the DSA hazard and accident analyses that the WIPP facility is operated and maintained by personnel who are qualified and competent to carry out their job responsibilities using current and well-developed procedures.

Human Factors Process (DSA Chapter 13) – examine the importance of human factors in facility safety and to analyze the human-machine interfaces with SSCs important to safety or that provide DID.

Quality Assurance Program (DSA Chapter 14) – assure that work at WIPP is planned, documented, performed under controlled conditions, and periodically assessed in order to help ensure overall worker and public safety associated with WIPP operations.

Emergency Protection Program (DSA Chapter 15) – provide an organized plan of action for handling emergencies at WIPP and for mitigating their effects on workers and the off-site public.

Decontamination and Decommissioning Plans (DSA Chapter 16) – minimize the long-term effects of WIPP on the environment by providing a means of decontamination and decommissioning of surface and subsurface structures, restoring the site surface area to preconstruction and preoperational conditions, and to warn future generations of the presence of the WIPP repository.

Management, Organization, and Institutional Safety Programs (DSA Chapter 17) – ensure that WIPP is operated by the management and operating contractor under a management and organizational structure that promotes an effective safety culture supported by institutional safety programs.

All of these SMPs have been in place since the beginning of WIPP CH handling and disposal operations and have exhibited demonstrated effectiveness. The programs were also evaluated for necessary changes for effectiveness in RH operations and they were evaluated as being effective. In the CH SER, one exception was taken in the criticality safety program. The Nuclear Criticality Safety Evaluation (NCSE) for WIPP (SAIC 1171-001, Rev. 1) was originally adapted from the transportation safety analysis report for packaging (SARP) NCSE used for TRU waste transportation criticality safety modeling and NRC licensing for national transportation of TRU waste to the WIPP site. While this model is conservative and is intended to consider all possible transportation accident scenarios that could lead to a criticality event, it is not representative of the normal and accident conditions which would be present at the WIPP, either surface or underground. To this extent, the storage and disposal of TRU waste represents a unique and different set of hazards and conditions that would influence the occurrence of a criticality. It was identified in the CH SER that the current NCSE needed to be revised to reflect a more representative base case and contingency analyses, which may analyze the form, distribution, credible masses, geometry, neutron poisons, and fuel density, as well as any other consistent factors that would influence the nature of criticality as it relates to storage in the WHB and disposal underground at the WIPP. This condition does not apply to the storage and disposal of RH waste. With the current authorized and DSA analyzed storage and disposal configurations, criticality is a non-credible event since the RH waste canisters are essentially neutronically isolated in interim storage and disposal configurations.

All of these SMPs undergo frequent internal and external reviews and are constantly undergoing process improvement to make them even better and more effective. DOE finds these SMPs to be adequate to perform their safety-related functions and for providing a basis from which the TSR programmatic ACs may be constructed.

5.0 TECHNICAL SAFETY REQUIREMENTS

The TSR document contains the WIPP RH TRU Waste TSRs that define the performance requirements of SSCs, administrative controls, and design features to ensure the safe operation of WIPP for RH operations. All commitments for safety controls made in the RH DSA as a result of the hazard and accident analyses provided in Chapter 3 have been captured in appropriate TSR provisions.

Due to the nature of WIPP RH and CH operations and the design of the facility, many of the TSRs for the WIPP facility are expressed in the form of specific or programmatic ACs. However, for RH operations, there are several LCOs for the WHB fire suppression system, underground RH waste handling equipment automatic/manual fire suppression system, the underground ventilation system, and numerous interlocks to protect the facility worker from direct exposure accidents. Where ACs or SACs are employed, justification for treating them as such has been provided in the hazard and accident analyses in Chapter 3 of the RH DSA in the discussions of the specific hazards or accidents to which they apply. DOE agrees that this strategy has been appropriately justified in the DSA.

DOE concludes as a result of its review of the specific TSRs that all TSRs are adequately defined and supported by justifiable basis statements and surveillance requirements in accordance with the guidance in DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*. In addition, DOE finds that specific administrative controls have been appropriately differentiated from programmatic ACs and have been established in a manner consistent with DOE-STD-1186, *Specific Administrative Controls*.

In its review of the specific TSRs, DOE notes that a completion time of 48 hours is invoked upon failure of the automatic fire suppression system on a piece of RH waste handling equipment. DOE recognizes that 48 hours are necessary to allow placing the waste in the safest condition and repair or replacement of the equipment. DOE agrees that the increase in risk of a fire that could result in radioactive and/or hazardous material release during this time period is extremely small given the use of a fire watch and other preventive and mitigative factors, including the fact that controls to prevent collision are still in place and manual actuation of the fire suppression system is still available, and the fact that waste handling equipment is powered by diesel fuel instead of gasoline. DOE accepts this extremely small increase in risk. DOE notes, however, that in the event that both automatic and manual portions of the fire suppression system are compromised, the completion time is reduced to 4 hours and agrees that this is a reasonable completion time under these circumstances.

6.0 RECORDS

Review of Revision 0 of the WIPP RH DSA and its associated TSRs was conducted in accordance with the general requirements in DOE-STD-1104-96 (Change Notice 3). This review generated a Document Review/Approval Matrix (DR/AM) providing the formal request for review of the document, and delineating the individual CBFO reviewers and the type of review to be conducted by each; and formal Document Review Records (DRRs) containing comments on the RH DSA and TSRs documents by the review team and the corresponding responses to those comments by the DSA and TSRs document authors. The DR/AM and DRRs

are a part of the Administrative Record associated with this review and are available for inspection at CBFO.

7.0 CONDITION OF APPROVAL

The DOE's approval of Revision 0 of the WIPP RH DSA and associated TSRs document is not subject to any conditions.

8.0 CONCLUSIONS

Based on the results of the review team's assessment of Revision 0 of the WIPP RH DSA and TSRs, DOE concludes that WIPP RH TRU waste operations are safe and will pose minimal risk to workers, the public, and the environment if conducted within the safety basis documented in the DSA and TSRs. The DOE thus approves Revision 0 of the WIPP RH DSA and TSRs.

9.0 EFFECTIVE DATE

To allow for a reasonable implementation period, and in accordance with the memorandum from the Assistant Secretary for Environmental Management dated May 28, 2002, entitled Supplemental Environmental Management (EM) Guidance for Implementing 10 CFR 830, Subpart B, Safety Basis Requirements, the effective date of Revision 0 of the WIPP RH DSA and TSRs shall be based upon the following:

- completion of a satisfactory Operational Readiness Review,
- receipt of the modification to the WIPP Hazardous Waste Facility Permit to allow RH waste disposal operations, and
- declaration of commencement of RH operations

provided that not more than 180 days has elapsed since the issuance of this SER and no new conditions requiring modifications to the DSA or TSRs have been discovered.
The period of 180 days may be extended at the request of the management and operating contractor by memo from CBFO should it be determined by CBFO that additional time is necessary to complete preparation for WIPP RH operations.